JACC Vol 7, No 6
June 1986 1196–200

Task Force I: Training in Clinical Cardiology

ROBERT L. FRYE, MD, FACC, Co-Chairman, WILLIAM W. PARMLEY, MD, FACC, Co-Chairman,
BRUCE BRUNDAGE, MD, FACC, NICHOLAS FORTUIN, MD, NOBLE O. FOWLER, MD, FACC,
VALENTIN FUSTER, MD, FACC, W. PROCTOR HARVEY, MD, FACC,
J. WILLIS HURST, MD, FACC, JOHN W. JOYCE, MD, CHARLES E. RACKLEY, MD, FACC,
ELLIOT RAPAPORT, MD, FACC, RICHARD J. REITEMEIER, MD, FACC,
RICHARD O. RUSSELL, Jr., MD, FACC, THOMAS J. RYAN, MD, FACC,
DONALD E. SAUNDERS, Jr., MD, FACC

The training experience in clinical cardiology is fundamental to the development of the specialist in cardiovascular medicine. It should provide a broad exposure to acute and chronic cardiovascular diseases emphasizing accurate clinical bedside diagnosis, appropriate ordering of decisive testing and integration of all data into a well communicated consultation, with sensitivity to the unique features of each individual patient. In addition, active participation in research projects will provide further experience in critical thinking. The knowledge, skills and experience so realized are essential to providing a solid foundation in clinical cardiovascular medicine before focusing on more specialized areas, which, for some, may become the dominant feature of professional activity. Without such a broad clinical background and an emphasis not only on the pathophysiology of disease but also on the humanistic, moral and ethical aspects of medicine, our training efforts could result in the generation of highly specialized technicians without the broad insight necessary for true consultants in cardiovascular medicine.

I. General Aspects of Training

A. Training institutions. Programs of training in cardiology must be accredited and be offered only in university or university-affiliated institutions that have a residency training program in internal medicine and in cardiovascular disease fully accredited by the Accreditation Council for Graduate Medical Education.

B. Prerequisites for training. Training in cardiology should take place after successful completion of at least 3 years of postdoctoral education in internal medicine. This training in internal medicine should not be utilized to fulfill requirements in cardiology.

C. Objectives of training. The general principles enumerated in the General and Special Requirements for Graduate Education in Internal Medicine (1) are also applicable to training in cardiology. Cardiology training programs must provide an intellectual environment for acquiring the knowledge, skills, clinical judgment, attitudes and values that are essential to cardiovascular medicine. Fundamental to this training is the provision of the best possible care for each individual patient in a compassionate manner. All physicians undergoing training in cardiology must have and maintain the humanistic and ethical attributes of the general internist (1–3).

The objectives of a training program in cardiology can be achieved only when the program leadership, supporting staff, faculty and administration are fully committed to the educational program and when appropriate resources and facilities are present. Effective graduate education is not achieved if the training program, as established, functions primarily to meet service commitments. During training in cardiology, trainees should be encouraged to cultivate an attitude of scholarship and dedication to continuing education that will remain with them throughout their professional careers. The development of a scholarly attitude includes active participation in and completion of one or more research projects, ideally followed by publication in critically reviewed journals, or a thesis. These activities will provide additional experience in critical thinking and will help develop an attitude of scholarship and greater insight into the problems of analyzing and reporting data and other observations.

D. Role of the specialist and duration of training. Training in cardiology must take account of the role that the cardiovascular specialist is likely to play in the health care delivery system of the future. Strong forces are now operating that will likely increase the percent of physicians who will be primary care givers and cause a corresponding

0735-1097/86/$3.50

reduction of subspecialists of all types, including cardiologists. Simultaneously, as a consequence of the aging of the population, the demand for cardiovascular care will increase. Cardiovascular specialists will have to serve as high level expert consultants and technical specialists, and the training must reflect this expanded role.

At the same time, the explosion of basic information in cardiovascular science and the enormous technical developments mandate that the duration of training be expanded to 3 years. The safety of patients is also at stake. This training should include a core of 24 months with a *minimum* of 1) 10 months in nonlaboratory clinical practice activities (consultations, coronary care units, surgery, pediatrics and so forth), 2) 4 to 6 months in the cardiac catheterization laboratory, 3) 5 months in noninvasive imaging (echocardiography, nuclear cardiology techniques, nuclear magnetic resonance and other techniques that may evolve), and 4) 4 months in electrocardiography, stress testing, ambulatory electrocardiographic monitoring, permanent pacemaker implantation and follow-up and electrophysiologic studies.

These periods are necessary to learn appropriately the indications, interpretative skills and knowledge of complications of these procedures. This core 24 month training period does not qualify a trainee as a consultant in cardiovascular diseases or as an expert in these technical skills.

The remaining time in the program should be tailored to the individual trainees' interests and future career goals, and may include the acquisition of additional, second level training in special areas of cardiovascular medicine or research training, or both. Trainees require additional, often second level, training during the third period of 12 months to be qualified to function properly as consultants in cardiovascular diseases and as specialists in cardiology. This period permits the trainees opportunity to obtain greater experience and supervised training in the clinical management of patients with cardiovascular disease and to obtain additional, second level training to gain skills for the independent application of particular diagnostic or therapeutic procedures. Vacation time should also be included in the remaining time.

E. Program faculty. The program must be conducted under the auspices of a program director who is highly competent in the specialty of cardiovascular diseases and fully committed to the training of the cardiovascular specialist. The director of the cardiology training program must be certified by the American Board of Internal Medicine Board of Cardiovascular Diseases or possess suitable equivalent qualifications. The director is responsible for the adequacy of the facility, including support resources for the provision of an education of high quality. There should be sufficient numbers of the full-time and part-time faculty in the Division (or Section) of Cardiology to guarantee close supervision of all trainees and to allow for the critical evaluation of the program and the competence of the trainees. It is essential that the cardiology program director devote sufficient time and effort to the graduate education program and related activities. Cardiology program directors must be full-time faculty members. The program director must have the effective support of the institution or institutions where the training takes place so as to provide these educational attributes.

II. Environment for Training in Clinical Cardiology

A. Interaction with other disciplines. Cardiology training programs must provide an intellectual environment for acquiring the knowledge, skills, clinical judgment and attitudes that are essential to the practice of cardiovascular medicine. Specialists in cardiovascular diseases must interact with specialists in other areas and have knowledge of other specialties in order to provide excellent patient care. Thus, the training program should enable the trainee to cultivate an appreciation of the importance of interaction with other disciplines through the availability of collaborating consultants and suitable patients. Close interaction with cardiovascular surgery is of particular importance. The overall program must provide advanced training to allow the physician to acquire expertise as a specialist and consultant in cardiology.

B. Relation to training in internal medicine. Cardiology training programs must provide the opportunity for cardiology trainees to maintain their skills in general internal medicine as well as in those aspects of cardiology that relate to internal medicine. The cardiology program must be closely related to the training program in internal medicine, and there must be closely delineated lines of responsibility for the residents and staff in internal medicine and the cardiology trainees. There must be close working contact by the trainees with residents and fellows in other areas, including surgery, anesthesia, radiology, pulmonary disease, pathology, pediatrics and neurology. When appropriate, teaching and supervision by expert faculty in these disciplines should occur.

C. Required training program resources. The program must have certain minimal resources, including the following:

1. There must be adequate inpatient and outpatient facilities with an appropriate number of patients of a wide age range with a broad variety of cardiovascular disorders. Trainees must be supervised when seeing patients in both facilities.
2. The facility must provide laboratories for cardiac catheterization, electrocardiography, exercise tolerance testing and echocardiography. (See also reports of Task Forces II, III and IV.)
3. Facilities for nuclear cardiology must be available. (See also report of Task Force V.)

JACC Vol 7, No 6
June 1986 1196–200

4. There must be appropriate facilities for the assessment of patients with a cardiac pacemaker and their long-term management. (See report of Task Force VI.)
5. Facilities and faculty for training in cardiovascular research are mandatory. (See report of Task Force VIII.)
6. There must be modern intensive cardiac care facilities.
7. There must be facilities for cardiac surgery and cardiac surgery intensive care. Close association with and participation in a cardiovascular surgical program is an essential component of the cardiovascular training program. This must include active participation in the pre- and postoperative management of patients with cardiovascular disease.
8. There must be appropriate facilities for the assessment of patients with systemic hypertension.
9. There must be facilities for assessment of peripheral vascular disease, pulmonary dysfunction and cardiovascular roentgenography.
10. There must be other appropriate facilities necessary to accomplish the training, including a comprehensive medical library.

D. Recommended training resources. The program should have facilities for specialized electrophysiologic studies. (See report of Task Force VII.)

III. Training Components

An educational clinical cardiovascular disease training program must have the following training objectives and characteristics and must encompass the following areas:

A. Training in patient care and management. All trainees must be skilled in obtaining a history and performing a complete cardiovascular physical examination. All trainees must be familiar with the role of psychogenic factors in the production of symptoms and the emotional and physical response of patients to cardiovascular diseases. They must be familiar with the importance of preventive and rehabilitative aspects of the management of patients with known or potential cardiovascular disease. The trainee should have considerable experience acting as a consultant to other physicians and should have direct patient care responsibility under supervision in proportion to his or her experience and qualifications.

B. Training in understanding, diagnosis, prevention and treatment of cardiovascular diseases. The trainee must become well educated in pathogenesis, pathology, risk factors, natural history, diagnosis by history, physical examination and laboratory methods, medical and surgical management, complications and prevention of many cardiovascular conditions, including coronary artery disease, hypertension, valvular heart disease, congenital heart disease, cardiac arrhythmias, cardiomyopathy, involvement of the cardiovascular system by systemic disease, infective endocarditis, diseases of the great vessels and peripheral blood vessels, diseases of the pericardium, pulmonary heart disease, cardiovascular complications of chronic renal failure, traumatic heart disease and cardiac tumors.

C. Training in intensive care. The training must include at least 3 to 4 months of full-time experience with patients undergoing intensive care for acute cardiovasular disorders and acute coronary care.

D. Training in follow-up care. Continued responsibility for outpatient cardiovascular patient management and consultations must occupy at least one-half day per week for 36 months or an equivalent period. Longitudinal follow-up of patients is desirable. There should be exposure to a wide age span of patients from adolescence through old age.

E. Training in electrocardiography. All cardiovascular trainees must be skilled in the interpretation of electrocardiograms. There must be appropriate review and audit and evaluation of their skills. All cardiology trainees must be skilled in the performance and interpretation of exercise electrocardiographic tests and ambulatory electrocardiography. (See report of Task Force II.)

F. Training in cardiac catheterization laboratory. There must be direct experience under supervision in a general adult cardiac catheterization laboratory that performs both right and left heart catheterizations. This initial experience in the cardiac catheterization laboratory must emphasize the fundamentals of cardiovascular physiology as it relates to clinical disease, the analysis of hemodynamic records and interpretation of angiographic images. Such an experience must also emphasize the problems in interpretation and analysis of such data and the importance of quality. All fellows must have adequate training in the principles of radiation safety. The amount of training in the mechanical skills of cardiac catheterization is addressed by Task Force III. The acquisition of advanced skills is not the primary purpose of the initial exposure of the trainee to the cardiac catheterization laboratory. (See report of Task Force III.)

G. Training in echocardiography. All trainees must participate in the performance of echocardiograms and Doppler echocardiography. Those wishing to perform this technique or to direct an echocardiographic laboratory require additional training. (See report Task Force IV.)

H. Training in nuclear medicine. All trainees must know the general principles and indications and limitations of nuclear cardiovascular procedures, including nuclear magnetic resonance (NMR) studies. All trainees must receive basic training in radiation safety. Those trainees wishing to perform these tests or to direct a nuclear cardiology laboratory or perform NMR studies must have additional training as described by the report of Task Force V.

I. Training in cardiac pacing. All trainees must know the indications for cardiac pacemakers and the principles of management of patients with implanted pacemakers, as described by the report of Task Force VI.

J. Training in electrophysiology. All trainees must be skilled in the selection of patients for specialized electrophysiologic studies; those wishing to perform these should receive additional training, as described in the report of Task Force VII.

K. Training in peripheral vascular disease. The trainee must develop sound knowledge of the clinical features and treatment of peripheral vascular disease, demonstrate competency in the historical and physical examination of the arterial and venous systems and should become proficient in selecting and interpreting peripheral angiography, imaging, Doppler vascular studies and plethysmography.

L. Training in cardiovascular research. All trainees should participate actively in research activities. Trainees who anticipate a career in academic cardiology or who plan to actively pursue cardiovascular research must have additional specialized training, as described by the report of Task Force VIII.

M. Training in related sciences. The training program must provide an opportunity for continuing education in basic sciences, including those aspects of anatomy, physiology, pharmacology, pathology, biophysics and biochemistry that are pertinent to cardiology. The availability of educational programs in biostatistics, computer sciences and biophysics is highly desirable. It is essential for trainees to acquire a thorough understanding of the normal physiology of the circulatory system, including the adaptation of the cardiovascular system to exercise, stress, pregnancy, aging, renal and pulmonary abnormalities and the interpretation of tests of renal and pulmonary function.

N. Training in related fields of medicine. The trainee must gain knowledge and experience in a number of related areas of medicine including the following:

1. *Radiology*. The interpretation of cardiovascular roentgenograms with particular reference to vascular structures and special cardiovascular radiologic procedures.
2. *Surgery*. The risks and benefits of cardiovascular surgery and the rationale for the selection of candidates for surgical treatment; the pre- and postoperative management of patients with cardiovascular disease.
3. *Anesthesia*. Close collaboration with anesthesia colleagues in the pre- and postoperative management of patients with cardiac disease.
4. *Pulmonary disease*. A solid knowledge of basic pulmonary physiology in addition to the interpretation of pulmonary function testing, interpretation of blood gases, pulmonary angiography, radioactive lung scanning methods and experience with the management of patients with acute pulmonary disease.
5. *Obstetrics*. A solid knowledge of the interrelations between pregnancy and heart disease together with experience in the clinical management of patients with heart disease who are pregnant.
6. *Physiology*. The physiology of the cardiovascular system, its response to exercise and stress and the alterations produced by disease.
7. *Pharmacology*. The pharmacology and interreactions of cardiovascular drugs.
8. *Pathology*. Familiarity with the gross and microscopic pathology of all major forms of heart disease.

O. Training through conferences, seminars, literature review, lectures. There must be regularly scheduled cardiology conferences, seminars and literature review activities. The participation of the trainees in the planning and production of these conferences is highly desirable. Attendance at multidisciplinary conferences is highly desirable, particularly conferences closely related to cardiovascular diseases such as conferences on surgery, radiology and pathology. Visiting professors should provide stimulation and evaluation.

P. Teaching experience. The trainee must participate directly in the teaching of cardiology and become familiar with the fundamental principles of education, including skills in organization of conferences, lectures and teaching materials. The teaching experience must attempt to collate basic biomedical information with the clinical aspects of cardiology, including integration of clinical management principles. Trainees must be familiar with modern concepts of education and effective communication. They must be responsible for teaching and supervising residents in internal medicine as well as medical students, other cardiology trainees and allied health personnel. They must have regularly scheduled experiences in teaching and must be encouraged to attend and participate in national cardiology meetings.

IV. Special Technical Areas

In specific technical areas of cardiology, minimal training is appropriate for physicians who do not plan to achieve additional qualifications in a given field. Conversely, those physicians who wish to have additional qualifications in specialized areas require additional training as specified by the individual Task Forces.

V. Evaluation and Documentation of Competence

A. Evaluation. The evaluation of trainees for both clinical and specialized technical skills must be carefully documented. Cardiology program directors must establish procedures for the regular evaluation of the clinical competence of the cardiology trainees. This evaluation must include intellectual abilities, manual skills, attitudes and interpersonal relation as well as specific tasks of patient management, clinical skills, including decision-making skills, and the critical analysis of clinical situations. There must be provision for appropriate feedback of this information to the

JACC Vol 7, No 6
June 1986 1196–200

subspecialty trainee. Records must be maintained of all evaluations and of the number and type of invasive laboratory procedures performed by each trainee. Examinations should be given at the end of each year of training.

B. Certification. Trainees who develop added qualifications in specialized areas of cardiology and who pass an appropriate external examination should receive special certification in recognition of this added experience and qualifications under the auspices of a member board of the American Board of Medical Specialties.

References

1. Special Requirements for Residency Training in Internal Medicine and for Graduate Education in the Subspecialties of Internal Medicine. Directory of Residency Training Programs, 1985–1986 Chicago: American Medical Association, 1986:31–6.

2 American Board of Internal Medicine, Subcommittee on Evaluation of Humanistic Qualities of the Internist. Evaluation of humanistic qualities in the internist. Ann Intern Med 1983;99:720–4

3. American College of Physicians Ad Hoc Committee on Medical Ethics. American College of Physicians Ethics Manual. Ann Intern Med 1984;101:129–37 and 263–74.